

# Health Consultation

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SIMPSON PARK LAKE

ST. LOUIS COUNTY, MISSOURI

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES  
Public Health Service  
Agency for Toxic Substances and Disease Registry  
Division of Health Assessment and Consultation  
Atlanta, Georgia 30333

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In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

SIMPSON PARK LAKE

ST. LOUIS COUNTY, MISSOURI

Prepared By:

Missouri Department of Health and Senior Services  
Division of Community and Public Health  
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Bureau of Environmental Epidemiology  
Under a Cooperative Agreement with the  
U.S. Department of Health and Human Services  
Agency for Toxic Substances and Disease Registry (ATSDR)

## **STATEMENT OF ISSUES**

The Missouri Department of Conservation (MDC) requested that the Missouri Department of Health and Senior Services (DHSS), in conjunction with the federal Agency for Toxic Substances and Disease Registry (ATSDR), complete a health consultation to evaluate the potential risk of adverse health effects from eating largemouth bass, buffalo, and crappie taken from Simpson Park Lake. This health consultation will evaluate fish tissue data from largemouth bass, buffalo, and crappie collected by the MDC and Missouri Department of Natural Resources (DNR) from Simpson Park Lake.

## **BACKGROUND**

### **Simpson Park Lake**

Simpson Park Lake is a 72-acre lake located in Simpson Park at 1234 Marshall Road in St. Louis County north of I-44 on Route 141 (Meramec Station Road). The lake is fed by Grand Glaize Creek and is located near the Meramec River. The St. Louis County Parks Department acquired 148 acres of land, which would become Simpson Park, in 1976; half of the land was purchased by St. Louis County Parks Department and the other half donated by Simpson Sand and Gravel Company (1). Since 1976, other property has been purchased or donated to add to the current 206-acre park (1). See Figure 1.

The construction of the dam for Simpson Park Lake was started in 1955. The purpose of the dam at that time was to impound water from the Grand Glaize Creek to allow the Simpson Sand and Gravel Company to float a dredge barge to dredge sand and gravel. This dredging process continued until the 1970's and increased the size of the lake. The dam was upgraded in the early 1990's, and the park was dedicated in 1991. (1)

In 1993, the St. Louis County Parks Department and MDC formed an agreement for MDC to manage the fish in Simpson Park Lake. Currently, Simpson Park Lake supports at least 39 different fish species including: largemouth bass, spotted bass, yellow bass, white bass, crappie, bluegill, sunfish, warmouth, smallmouth buffalo, bigmouth buffalo, quillback, suckers, gar, freshwater drum, carp, channel catfish, bullhead, and paddlefish. Fishing regulations for the park include a daily limit of 2 largemouth or spotted bass greater than 18 inches, 4 catfish of any size, 15 crappie of any size, and 10 of all other fish combined. Fishing at Simpson Park Lake is considered very good for crappie and black bass (which includes largemouth bass and spotted bass), fair for catfish, poor for sunfish, and very poor for all other species. Fisheries Biologist Kevin Meneau reports very few largemouth bass are taken from Simpson Park Lake due to the length and daily limits. Buffalo are rarely caught in Simpson Park Lake, primarily because they are seldom fished for and are primarily filter feeders. (2)

## Fish Advisory

Annually since 1985, the MDC and DHSS have worked with DNR, U.S. Environmental Protection Agency (EPA), and other government agencies to evaluate the amount of contaminants in Missouri sport-caught fish by collecting fish tissue data. DHSS uses the fish tissue data gathered to determine if there are health risks associated with eating fish from Missouri water bodies. All fish contain some small amount of chemical contaminants. In most instances and for most people, the health benefits of eating fish outweigh the potential health risks from contaminants. However, there are occasions when DHSS has determined that limited or even no consumption of fish is appropriate for some people. (3)

Each year DHSS creates a fish consumption advisory discussing the findings of the fish tissue data and informing individuals of any potential health risks associated with eating certain Missouri sport-caught fish. See Table 1 for a list of some current DHSS action levels for contaminants in fish. The fish advisory provides advice on the amount of fish which is safe to eat and encourages individuals to eat a healthy diet that includes fish. For the Missouri Fish Advisory, one meal is considered to be 11 ounces of uncooked fish for a 150-pound person or 3 ounces of uncooked fish for a 40-pound child. (3)

**Table 1. DHSS Fish Consumption Advisory Action Levels**

Chemicals	Action Levels in parts per billion (ppb)			
	2 meals per week	1 meal per week	1 meal per month	Do not consume
<b>Pesticides</b>				
Sum of Chlordane isomers	6.7-12	12-48.0	48.0-110	>110
<b>Industrial pollutants</b>				
Total PCB	40-100	100-370	370-750	>750
Lead				≥300
Mercury	88-120	120-310	310-1,000	>1,000

PCB = polychlorinated biphenyl

Meal size is considered 11 ounces of uncooked fish for a 150-pound person or 3 ounces for a 40-pound child.

The fish advisory action levels are based on people eating fish fillets. Meal advice given in the fish advisory does not take into consideration contaminant levels that may exist in fish tissue other than the fillet, such as bone, fat, skin, and internal organs. Eating portions of fish other than the fillet tissue may result in higher exposures to contaminants. Many recommendations are made in the fish advisory on how fish can be prepared and cooked to reduce the amount of contaminants in the fish that are eaten. Since many contaminants tend to accumulate in bone, fat, skin, and/or internal organs, most of the recommendations made in the fish advisory involve removing these parts of the fish.

These recommendations include filleting the fish, trimming away fat, and cooking the fish in a way that allows the fat to drip away. Preparing fish in a way other than what is recommended in Missouri's fish advisory may increase an individual's exposure to contaminants.

Methylmercury is distributed throughout the fish; thus, filleting or cooking will not effectively reduce the concentration of methylmercury in fish.

Advisories on fish may be specific to one or two water bodies or may cover all of Missouri's water bodies. Currently, there is a statewide advisory for sensitive populations to eat no more than one fish meal per month of largemouth bass, smallmouth bass, or spotted bass that are greater than 12 inches in length, due to elevated mercury levels found in these bass throughout the state. For the fish advisory, a sensitive population includes women who are pregnant, women of childbearing age, nursing mothers, and children less than 13 years of age.

### Site Activities

MDC began sampling fish in Simpson Park Lake in 1985. In 2002, MDC collected fifteen largemouth bass from Simpson Park Lake. Tissue was taken from the fillets of these 15 largemouth bass and combined into 1 sample to be tested for lead, cadmium, and mercury. Mercury was detected at 333 parts per billion (ppb), which is comparable to mercury levels found in largemouth bass greater than 12 inches throughout Missouri. Lead and cadmium concentrations were below DHSS action levels.

In 2006, DNR collected two samples of largemouth bass and two samples of bigmouth buffalo from Simpson Park Lake. Each sample included fillets from multiple fish of similar length and weight. See Table 2. These samples will be referred to as LMB-1, LMB-2, BUF-1, and BUF-2 respectively throughout the rest of this document. LMB-1 and BUF-1 were collected in Spring of 2006, while LMB-2 and BUF-2 were collected in Fall of 2006. See Table 1 for a list of some current DHSS action levels for contaminants in fish.

**Table 2. 2006 Fish Tissue Data for Simpson Park Lake in parts per billion (ppb)**

Sample Number	LMB-1	LMB-2	BUF-1	BUF-2
Fish Species	Largemouth Bass	Largemouth Bass	Bigmouth Buffalo	Bigmouth Buffalo
Number of Fish in Sample	5	4	3	3
Average Length in Inches	15.7	13.6	16.8	16.8
Lead	2,310	1,130	<140*	<140*
Mercury	574	318	277	243
Chlordane	32.8	38	72.7	58.8
PCBs	ND	ND	63.5	89

PCB = polychlorinated biphenyl

\* = Lead was reported as not detected; however, the lowest reportable concentration of lead during this testing event was 140 ppb.

ND = not detected = The concentration in the fish tissue was too low for the laboratory to detect.

These samples were then sent to EPA for laboratory testing along with all other fish tissue samples collected by DNR throughout Missouri. Laboratory analyses of all Missouri samples were reported back to DNR in August 2007. Fish tissue sample results found lead concentrations of 2,310 ppb in LMB-1 and 1,130 ppb in LMB-2. Other contaminants of concern in LMB-1 were mercury with a concentration of 574 ppb and chlordane with a concentration of 32.8 ppb. Other contaminants of concern in LMB-2 included mercury at a concentration of 318 ppb, and chlordane at a concentration of 38 ppb. See Table 2 for a list of the fish tissue results.

Lead was not found in buffalo samples BUF-1 and BUF-2. However, fish tissue from BUF-1 had 72.7 ppb of chlordane, 277 ppb of mercury, and 63.5 ppb of polychlorinated biphenyls (PCBs). Similarly, fish tissue from BUF-2 had 58.8 ppb of chlordane, 243 ppb of mercury, and 89 ppb of polychlorinated biphenyls (PCBs). See Table 2 for a list of the fish tissue results.

In response to these results, MDC worked with DHSS and the St. Louis County Parks Department on determining appropriate health-protective action. In February 2008, DHSS, MDC, and the St. Louis County Parks Department developed signs and appropriate messages to be posted at access points around Simpson Park Lake prior to the start of fishing season. On March 1, 2008, DHSS issued the 2008 Fish Advisory, which included a do-not-eat advisory for largemouth bass greater than 12 inches in length taken from Simpson Park Lake. The 2008 Fish Advisory also recommended individuals eat no more than one meal per month of buffalo greater than 16 inches in length taken from Simpson Park Lake.

In January 2008, MDC collected 2 samples of largemouth bass and 2 samples of crappie from Simpson Park Lake. Crappie were sampled because they are the most popular sport-caught fish in Simpson Park Lake. Each sample included fillets from 5 fish of similar length and weight. These samples were sent to a different laboratory and were only tested for lead in order to get rapid results. In addition, the fish tissue samples collected by DNR in 2006 had been retained and were also sent to this different laboratory for reanalysis. The sample results of the fish collected in January 2008 showed lead concentrations in all 4 samples to be less than 2 ppb. Results of the retesting on DNR fish samples showed similar results as the EPA laboratory, with lead concentrations in LMB-1 of 1,300 ppb, LMB-2 of 730 ppb, BUF-1 of 84 ppb, and BUF-2 of 98 ppb.

Large rain events caused water levels in the Meramec River and Simpson Park Lake to rise to levels that resulted in these 2 water bodies joining 4 separate times in 2008. Between mid-March and mid-April of 2008, these water bodies flooded and temporarily merged 3 times. See Figure 2. The Meramec River flooded and temporarily merged with Simpson Park Lake again on September 15, 2008. It is not known whether there was an exchange of fish between Simpson Park Lake and the Meramec River during these flooding events. However, there are no fish advisories specific to the Meramec River.

MDC returned to Simpson Park Lake on October 3, 2008, and collected 2 samples of largemouth bass, 2 samples of white crappie, and 2 samples of bigmouth buffalo for analysis. Each sample included fillets from 5 fish of similar length and weight. These samples will be referred to as LMB-3, LMB-4, WC-1, WC-2, BUF-3, and BUF-4 respectively throughout the rest of this document. See Table 3.

The fish collected by MDC on October 3, 2008 were tested for lead and mercury concentrations. The results of these tests showed lead concentrations in the largemouth bass samples to be equal to or less than 6 ppb and mercury concentrations below 200 ppb. Both white crappie samples were found to have lead concentrations less than 6 ppb and mercury concentrations below 100 ppb. The bigmouth buffalo samples contained lead concentrations below 25 ppb and mercury concentrations of 230 ppb in BUF-3 and 270 ppb in BUF-4. See Table 1 for a list of some current DHSS action levels for contaminants in fish.

**Table 3. October 3, 2008 Fish Tissue Data for Simpson Park Lake in parts per billion (ppb)**

Sample Number	LMB-3	LMB-4	WC-1	WC-2	BUF-3	BUF-4
Fish Species	Largemouth Bass	Largemouth Bass	White Crappie	White Crappie	Bigmouth Buffalo	Bigmouth Buffalo
Number of Fish in Sample	5	5	5	5	5	5
Average Length in Inches	14.9	15.1	11.0	8.7	18.8	18.1
Lead	<6	6	<6	<6	17	23
Mercury	190	170	70	61	230	270

### **Health Benefits of Eating Fish**

Certain types of fish are beneficial for the health of individuals, especially for nursing mothers and growing children. Fish is a good source of the omega-3 fatty acids, which are essential in the development of the central nervous system. Fish is low in cholesterol and is a good source of high-quality protein, a “heart healthy” combination of the omega-3 fatty acids, and essential nutrients and minerals such as iron and zinc that will contribute to a healthy diet if eaten regularly. (3)

Recent medical research provides evidence that both the young and old can have significant health benefits from eating fish. In adults, the death rate from heart disease was 36 percent lower among those who ate fish twice a week compared with those who ate little or no fish. The American Heart Association recommends individuals include fish in their diets due to evidence that shows a link between eating fish and lowered risk of death from coronary heart disease. (3)

Fish is a good source of the omega-3 fatty acids, eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which are essential in the development of the central

nervous system, may be beneficial in reducing heart disease, and may have other beneficial health effects. DHA is found in certain fish and is also found in humans in the cell membranes of the retina, brain, and other parts of the central nervous system. DHA's importance in development, vision, and learning has been demonstrated in several animal studies that have shown problems arise in these areas when DHA levels are low. (3)

## **TOXICOLOGICAL EVALUATION**

This section will discuss the potential adverse health effects of exposure to lead, mercury, chlordane, and PCBs. Non-cancerous health effects and the likelihood of the contaminant causing cancer will be evaluated.

### **Lead**

Lead is a naturally occurring metal found in the earth's crust. Lead has no characteristic taste or smell (4). It is mined and processed for use in various industries, and throughout most of its history, Missouri has been the top producer of lead in the country. Lead is used in some types of batteries, ammunition, ceramic glazes, medical equipment, scientific equipment, and military equipment (4). Lead is used in bullets and fishing sinkers; however, the use of lead in these products is being reduced because of its harm to the environment (4). At one time, lead was used as an additive in gasoline and in paint. Lead from gasoline was released into the air in automotive exhaust and deposited along roadways (4). Houses built before 1978 may contain lead based paint. Lead in the soils in the inner cities is often attributable to lead-based paint and leaded gasoline (4).

Lead has no nutritional benefits for humans. Exposure to lead can occur by inhalation or ingestion. Lead is not readily absorbed through the skin, so dermal contact is not an important route of exposure. Lead has the greatest effect on the nervous system, especially in young children. Pregnant women can experience complications with their pregnancy ranging from low birth rate to miscarriage if exposed to high concentrations of lead. (4) The Centers for Disease Control and Prevention (CDC) defines 10 micrograms of lead per deciliter of blood ( $\mu\text{g}/\text{dL}$ ) as the blood lead level that should prompt public health action (5). However, CDC reports that research provides evidence that adverse health effects can occur in children with blood lead levels below 10  $\mu\text{g}/\text{dL}$ , and that the 10  $\mu\text{g}/\text{dL}$  blood lead level is not intended to serve as a threshold for the harmful health effects of lead (5).

While the EPA considers lead to be a probable human carcinogen and the National Toxicity Program (NTP) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens, there have been no studies linking ingestion of lead contaminated fish with an increased cancer risk (4, 6). The American Cancer Society estimates less than half of men and slightly more than a third of women in the United States will develop some form of cancer in their lifetime (7). However, the primary health concern from exposure to lead in largemouth bass from Simpson Park Lake is the effects lead has on the nervous system, especially on children and fetuses.

## **Mercury/Methylmercury**

Of the different forms of mercury, methylmercury poses the greatest health risk from fish consumption because of its potential to bioaccumulate in fish, high stability, lipid solubility, and ability to penetrate membranes in living organisms (3). Also, most mercury quickly transforms to methylmercury in the environment. Therefore, methylmercury is the form of mercury considered when evaluating fish taken from Simpson Park Lake. Individuals with exposures to other sources of mercury may be at greater risk of adverse health effects.

Mercury can enter in the environment from natural sources through the breakdown of rocks and soil and from volcanic activity. However, human activities such as mining and burning of fossil fuels may account for one-third to two-thirds of the mercury released to the environment. Mercury is sometimes used in thermometers, barometers, batteries, electrical switches, dental fillings, and some herbal and religious remedies. Typically, the levels of mercury in the air are very low and do not pose a health risk. (8)

In water and soil, microorganisms and natural processes convert mercury into methylmercury. Plants and small aquatic organisms can quickly take up the methylmercury directly from the water or through the food they eat. (8) These plants and small aquatic organisms are eaten by small fish, which are eaten by larger fish. When large fish eat smaller fish, some of the methylmercury in the small fish is absorbed by the larger fish, which causes methylmercury to accumulate in their tissues. This results in large predator fish having much higher concentrations of methylmercury in their tissues than the concentration of methylmercury in the water. Once methylmercury is in the fish tissue, it may stay there for a long period of time. (3)

Nearly all fish contain some amount of mercury. However, this does not mean that eating fish will cause adverse health effects from mercury. In fact, for most individuals, the amount of mercury taken into the body from eating most fish is not a health concern. Whether or not a health concern exists is dependent on several factors, such as an individual's age, weight, amount of fish eaten, and the amount of mercury present in the fish they eat. Smaller and/or younger fish tend to have lower levels of mercury in their bodies, because they consume smaller prey and have not lived long enough to accumulate as much mercury in their bodies. (3)

The EPA has determined that methylmercury is a possible human carcinogen; however, the primary health effect of ingesting methylmercury is impaired neurological development, especially in children. In cases of exposure to high levels of methylmercury, impaired central nervous system function and kidney damage or failure may occur. Impairment of the central nervous system function from methylmercury may include paresthesia (abnormal sensations of skin such as numbness, tingling, prickling, or burning sensations), ataxia (shaky, unsteady movement), impaired hearing, and narrowing of visual field. At lower exposures, developmental delays and IQ deficits may occur in children. In some repeated poisoning incidents, people who ate contaminated fish or seed grains with high levels of methylmercury developed permanent damage to

the brain and kidneys. More recent studies have found that, along with being a neurotoxin, methylmercury increases risk for cardiovascular diseases. (3, 8)

### **Chlordane**

Chlordane is a man-made chemical used in the United States as a pesticide from 1948 to 1988. Prior to 1978, chlordane was used on crops, lawns, and gardens. In 1978, EPA canceled the use of chlordane on food crops and phased out other aboveground uses of chlordane over the next 5 years; however, from 1983 to 1988, chlordane was used for termite control. Production of chlordane is still allowed in the United States for export. (9)

Even though there are currently no approved uses of chlordane in the United States, chlordane remains in the environment for many years and is still found in food, water, air, and soil. It is also found in almost all humans. Individuals living in homes that were treated with chlordane may be exposed to more chlordane than others. (9)

Chlordane's effects on the body are typically on the nervous system, digestive system, and the liver. Swallowing small amounts of chlordane may cause headaches, irritation, confusion, weakness, vision problems, upset stomach, vomiting, stomach cramps, diarrhea, and jaundice. It is not known if chlordane may cause cancer in humans after long-term exposure. (9)

### **Polychlorinated Biphenyls (PCBs)**

PCBs are a group of synthetic organic chemicals that are sometimes known by their trade name, Aroclor. PCBs do not burn easily and are a good insulator. Because of these properties, PCBs were used as coolants and lubricants in transformers and other electrical equipment. The manufacturing of PCBs stopped in the United States in 1977 due to evidence that PCBs were accumulating in the environment and may cause harmful effects. (10)

PCBs can be carried long distances in the air and have been found all over the world. Once in the environment, PCBs do not break down easily and may remain for a long period of time. When in the water, PCBs are taken up into the bodies of small organisms and fish. As large fish eat the smaller fish containing PCBs, PCBs can bioaccumulate in the larger fish. Because of this, PCB levels can be higher in fish than the water they live in, especially in fish at the top of the food chain. (10)

Adverse health effects to individuals exposed to high levels of PCBs in the workplace include skin conditions, such as acne and rashes. Some studies on workers suggest that exposure to PCBs may also cause irritation of the nose and throat, gastrointestinal discomfort, changes in the blood and liver, and depression and fatigue. There also is evidence from workers and animals exposed to PCBs that PCBs may cause certain types of cancer, such as cancer of the liver and biliary tract. (10)

## **Children's Health**

In general, children are more likely than adults to become exposed to contaminants. In their daily activities, children have a tendency to have frequent hand-to-mouth contact and put non-food items into their mouths. Because of children's size, eating habits, and many other factors, it usually takes less of a contaminant to cause adverse health effects in children than adults. Because a child's body is still developing, chemicals may affect them differently than an adult.

### *Lead*

Children are more susceptible to lead poisoning than adults, and children are also more likely to be exposed to lead contaminated materials. Infants and young children can swallow and breathe lead in dirt, dust, or sand while they play on the floor or ground. Also, compared to adults, a larger proportion of the amount of lead swallowed will enter children's blood (4). While about 99% of the amount of lead taken into the body of an adult will leave as waste within a few weeks, only about 32% of lead taken into the body of a child will leave as waste (4). All of these factors result in children being more affected by lead than adults when exposed to similar lead concentrations in their environment.

When children are exposed to lead contaminated materials, a variety of adverse health effects can occur depending on the amount of lead to which they are exposed and the duration of exposure. These effects include learning disabilities, slowed growth, hyperactivity, impaired hearing, and at very high exposure levels, even brain damage (4). Lead has the greatest effect on the nervous system, especially in children. In children, low levels of lead can cause weakness in fingers, wrists, or ankles. Unborn children can also be exposed to lead through their mothers and are at risk of premature births, low birth weight, decreased mental ability, learning difficulties, and reduced growth as young children (4).

Yearly blood-lead testing before a child is 72 months old is key in determining if the child has been exposed to lead. Eliminating exposure pathways by controlling contamination sources, practicing good personal hygiene, and eating a proper diet high in calcium can reduce the risk of lead poisoning in children.

Exposure to lead may occur through improper handling of lead shots and sinkers. Children, and/or their guardian(s), handling lead shots and sinkers should take steps to limit their exposure to lead. These steps should include not putting lead shots and sinkers in the mouth and washing hands thoroughly before eating or putting hands in their mouth. Another step may include using shots and sinkers made out of compounds that are less toxic to humans and the environment.

### *Mercury*

Methylmercury, an organic form of mercury, is extremely toxic to humans. The primary health effect of ingesting methylmercury is impaired neurological development. Unborn and young children are at a greater risk of adverse health effects associated with

methylmercury because they are in the early stages of neurological development. Mothers who are exposed to methylmercury can pass methylmercury to their children through breast milk, and expectant mothers exposed to methylmercury can pass methylmercury to their fetuses in the womb. At low exposure levels, developmental delays and IQ deficits may occur in children. (3, 8)

#### *Chlordane*

Little information could be found about health effects of chlordane specifically on children. Because levels of chlordane can be found in human breast milk, women exposed to chlordane may pass chlordane to their children through breast milk. It is not known if chlordane will cause reproductive or birth defects in humans. (9)

#### *PCBs*

Children are exposed to PCBs in similar ways as adults. Adults who are exposed to PCBs at work can expose their children to PCBs by bringing their contaminated clothing home. Mothers who are exposed to PCBs can pass PCBs to their children through breast milk, and expectant mothers exposed to PCBs can pass PCBs to their fetuses in the womb. PCBs may affect children by decreasing their birth weight, affect their immune system, and possibly affect their nervous system. PCBs may also cause mild neurodevelopment delays in some children. (10)

## **DISCUSSION**

Finding high concentrations of lead in the tissue of largemouth bass taken from Simpson Park Lake in 2006 was surprising to all the agencies involved. The findings were unexpected, because even in Missouri water bodies heavily contaminated with lead, largemouth bass are not typically found with elevated lead concentrations. However, there were a few theories on how these elevated lead concentrations could be found. One theory was that the high lead levels could have been caused by incidental ingestion of a lead sinker by one or a few of the fish collected for the analysis in 2006. Another theory was that the laboratory made an error.

MDC and DHSS started working immediately on proving or disproving these theories. The theory that the elevated lead concentrations could be caused by incidental ingestion of a lead sinker by a fish was unlikely. This is because there were two separate largemouth bass samples collected with each being collected at different times of the year. To prove or disprove the theory of a laboratory error, MDC sent the same fish tissue samples to the same laboratory, in addition to a totally different laboratory for reanalysis. Both laboratories found high concentrations of lead in these largemouth bass fillets. This finding disproved the laboratory error theory.

Based on the information available at the time, DHSS added largemouth bass greater than 12 inches taken from Simpson Park Lake to Missouri's 2008 Fish Advisory. This advisory recommended that individuals not eat largemouth bass greater than 12 inches taken from Simpson Park Lake. This advisory for largemouth bass was issued because

testing of largemouth bass taken from Simpson Park Lake in 2006 showed lead concentrations greater than DHSS's do-not-consume action level of 300 ppb. In addition, these largemouth bass also had mercury concentrations above DHSS's action level to restrict fish consumption to no more than one meal per month and chlordane concentrations above DHSS's action level to restrict fish consumption to no more than one meal per week.

DHSS also added buffalo species greater than 16 inches taken from Simpson Park Lake to Missouri's 2008 Fish Advisory. This advisory recommends individuals limit their consumption of buffalo greater than 16 inches in length taken from Simpson Park Lake to no more than one meal per month. This advisory for buffalo was issued because testing of bigmouth buffalo taken from Simpson Park Lake in 2006 found chlordane concentrations above DHSS's action level to restrict fish consumption to no more than one meal per month. In addition, these bigmouth buffalo also had mercury concentrations above DHSS's action level to restrict fish consumption to no more than one meal per week and PCB concentrations above DHSS's action level to restrict fish consumption to no more than two meals per week.

After these advisories were issued, there have been many things occur that have lead to the reevaluation of the health risks associated with eating largemouth bass and buffalo taken from Simpson Park Lake. Largemouth bass collected from Simpson Park Lake in January 2008 had lead levels less than 2 ppb and another sampling event in October 2008 showed lead concentrations equal to or less than 6 ppb. These levels are much lower than DHSS's action level for lead and indicate little to no health risks associated with eating largemouth bass from Simpson Park Lake.

In addition to the sampling events conducted in January 2008 and October 2008, large rain events caused water levels in the Meramec River and Simpson Park Lake to rise to levels that resulted in these 2 water bodies joining 4 separate times in 2008. During these flooding events that caused the Meramec River and Simpson Park Lake to merge, it is not known whether there was an exchange of fish between Simpson Park Lake and the Meramec River. If there was an exchange of fish between Simpson Park Lake and the Meramec River during a flood event, it currently is not possible to predict which species or what size of fish would be most likely to migrate from one water body to the other.

Health risk was further evaluated by using EPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model. The IEUBK Model is designed to predict probable blood lead concentrations for children between six months and seven years of age who have been exposed to lead through various sources (air, water, soil, dust, diet, and in utero contributions from the mother). For the evaluation of largemouth bass from Simpson Park Lake, it was assumed that sensitive populations would consume no more than one fish meal of largemouth bass greater than 12 inches in length per month as recommended in Missouri's statewide fish advisory due to mercury levels. The model was run using the concentrations of lead detected in largemouth bass taken from Simpson Park Lake in 2006. When typical default parameters were used, it was found that there is low risk

associated with eating largemouth bass from Simpson Park Lake as long as individuals eat only one fish meal of largemouth bass per month.

However, the default parameters in the model do not take into consideration all of an individual's possible exposure to lead. An individual may be exposed to lead through other sources such as lead paint and other items containing lead including lead sinkers, certain toys, jewelry, herbal remedies, Mexican candies, water hoses, and others. Individuals can also be exposed to higher concentrations of lead than what was used in the default parameters, for example if their soil and/or drinking water contain elevated concentrations of lead. If an individual is exposed to any of these additional sources, their health risk may be greater.

Another factor taken into consideration when evaluating health risks is that Simpson Park Lake has an 18 inch length limit on largemouth bass, and that buffalo are rarely fished for and difficult to catch. A large portion of the largemouth bass over 18 inches and buffalo caught may be released. Therefore, it is likely that very few fish falling under the advisories for Simpson Park Lake are consumed even with no advisory present.

Because crappie is the most likely food source for individuals using this lake, MDC sampled crappie in January and October of 2008 (2). Laboratory testing of these samples showed lead levels in crappie less than 6 ppb, which is well below DHSS action level. Likewise, mercury levels in the October 2008 crappie sample were below all of DHSS's action levels for mercury. These results show no health risks associated with eating crappie taken from Simpson Park Lake from exposure to these contaminants.

## CONCLUSIONS

### Crappie:

No contaminants have been found in crappie taken from Simpson Park Lake above a level of concern, and there is no specific advisory on these particular fish. Because all fish have various levels of mercury, DHSS recommends sensitive populations consume no more than one fish meal per week from areas where no other advisory is present. The crappie analyzed from Simpson Park Lake did have mercury, but the mercury concentrations detected were below DHSS's action levels and were similar to mercury concentrations that could be found in crappie throughout Missouri. Therefore, eating crappie taken from Simpson Park Lake is considered a *No Apparent Public Health Hazard*. The no public health hazard category is used when individuals have not come into contact with any site-related hazardous substances. It is still recommended that sensitive populations follow the guidance given in the Missouri Fish Advisory and by EPA to eat no more than one fish meal per week due to nationwide mercury levels in fish.

### Largemouth bass:

Largemouth bass greater than 12 inches in length taken from Simpson Park Lake in 2006 were found to have concentrations of lead in fillet tissue above DHSS's do-not-consume action level. Concentrations of mercury and chlordane were also detected in the fillet

tissue of these largemouth bass collected in 2006, but these contaminant levels did not pose as much of a health risk as lead. Because very few largemouth bass are taken from Simpson Park Lake due to size and creel limits, it is not likely that a large number of largemouth bass are taken from Simpson Park Lake for consumption. Using lead concentrations found in largemouth bass taken from Simpson Park Lake in 2006, biological modeling showed health risks to be low as long as statewide advisories for largemouth bass were followed and individuals were not exposed to sources of lead above typical background concentrations.

In addition, sampling of largemouth bass taken from Simpson Park Lake by MDC in January and October of 2008 found lead concentrations in these largemouth bass to be well below levels of concern. For these reasons, eating largemouth bass greater than 12 inches taken from Simpson Park Lake is considered a *No Apparent Public Health Hazard*. The no apparent public health hazard category is assigned when exposure to contaminated media might be occurring, but the exposure is not expected to cause any harmful health effects. The DHSS will remove largemouth bass caught in Simpson Park Lake from the Missouri Fish Advisory for 2009. However, individuals should follow statewide recommendations made in the Missouri Fish Advisory for sensitive populations to eat no more than one meal of largemouth bass per month due to statewide mercury concentrations, as well as, follow the preparation steps and cooking methods discussed in the advisory.

#### Buffalo:

Buffalo greater than 16 inches in length taken from Simpson Park Lake in 2006 were found to have concentrations of chlordane in fillet tissue above DHSS's action level to consume no more than one meal per month. Because buffalo are filter feeders, they are rarely caught in Simpson Park Lake. Also, buffalo are not often sought after by most anglers; therefore, it is unlikely that individuals are eating enough buffalo from Simpson Park Lake to cause adverse health effects. Because of this, Simpson Park Lake is currently considered a *No Apparent Public Health Hazard* for buffalo. The no apparent public health hazard category is assigned when exposure to contaminated media might be occurring, but the exposure is not expected to cause any harmful health effects. However, the DHSS will keep buffalo species greater than 16 inches in length taken from Simpson Park Lake in the Missouri Fish Advisory in 2009 to inform individuals in the event that they do catch a species of buffalo while fishing at Simpson Park Lake with the intention of consuming it.

## RECOMMENDATIONS

1. Individuals should follow recommendations found in the most recent version of the Missouri Fish Advisory, including the guidance for preparing and cooking fish. The most recent version of the Missouri Fish Advisory can be found at <http://www.dhss.mo.gov/fishadvisory/> or by calling (573) 751-6102.
2. Because of the health benefits associated with eating fish, individuals should not stop eating all fish.

## **PUBLIC HEALTH ACTION PLAN**

The Public Health Action Plan (PHAP) for the Simpson Park Lake contains a description of actions to be taken by the Missouri Department of Health and Senior Services (DHSS), the Agency for Toxic Substances and Disease Registry (ATSDR), and other involved parties. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but provides an action plan to mitigate and prevent adverse human health effects resulting from past, present, and future exposures to contamination. Included is a commitment from DHSS and/or ATSDR to follow up on this plan to ensure that it is implemented.

1. DHSS/ATSDR will work with the MDC and St. Louis County Parks Department to provide health education for individuals who fish at Simpson Park Lake.
2. DHSS/ATSDR will coordinate with MDC and St. Louis County Parks Department to address community health concerns and questions as they arise and provide necessary community and health education.
3. DHSS will maintain and update the Missouri Fish Advisory in cooperation with MDC and DNR to provide current fish consumption advice to the public.

## CERTIFICATION

The Missouri Department of Health and Senior Services (DHSS) prepared this Simpson Park Lake Health Consultation under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with the approved methodologies and procedures existing at the time the health consultation was initiated. The Cooperative Agreement partner completed editorial review.



Technical Project Officer, CAT, SPAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.



Team Lead, CAT, SPAB, DHAC, ATSDR

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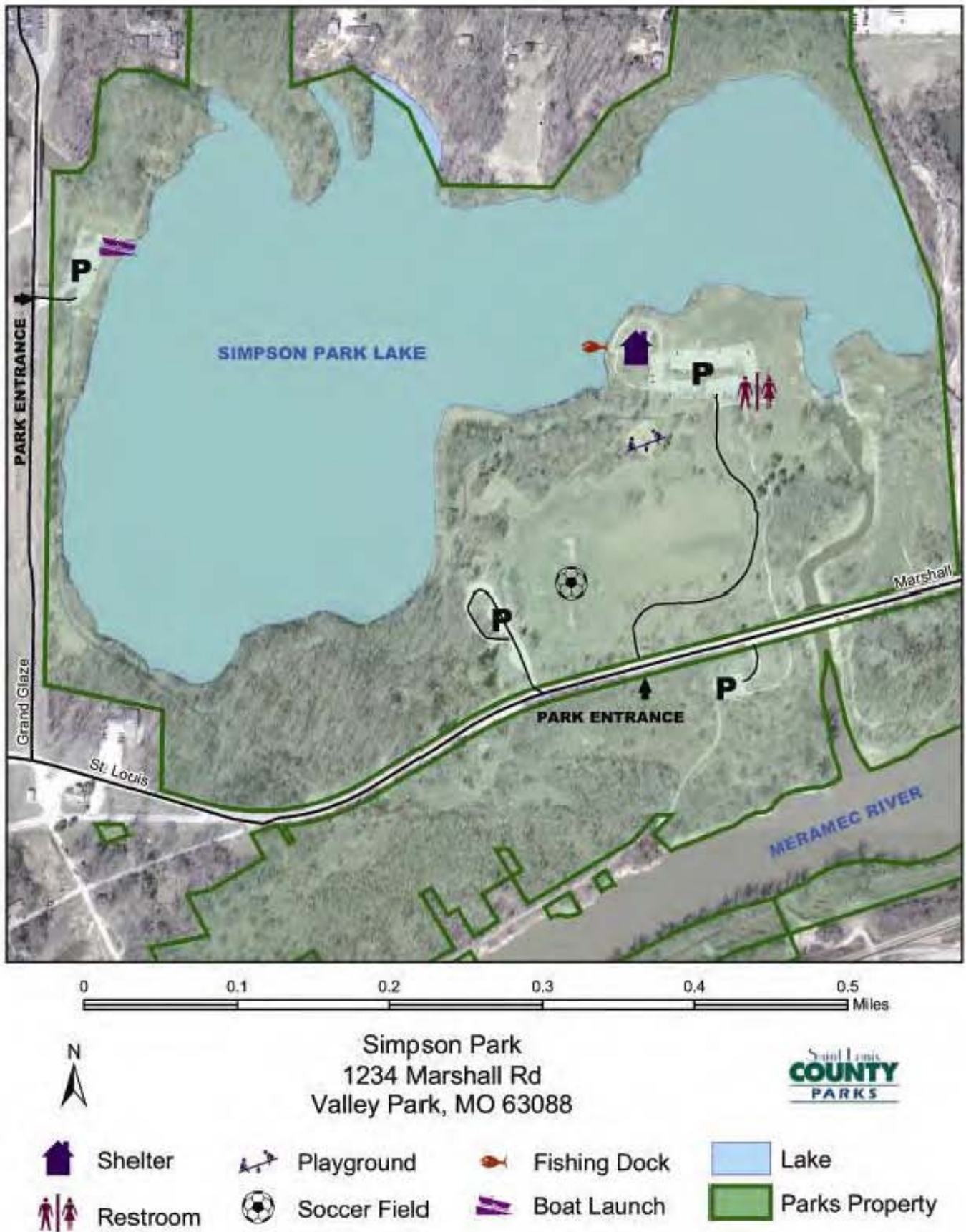
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Attachments: Figure 1: Map of Simpson Park Lake  
Figure 2: Flooding of Meramec River into Simpson Park Lake

**Figure 1**  
**Map of Simpson Park Lake**



**Figure 2**  
**Flooding of Meramec River into Simpson Park Lake**



Photo provided by the St. Louis County Parks Department.